QRTV-07-07

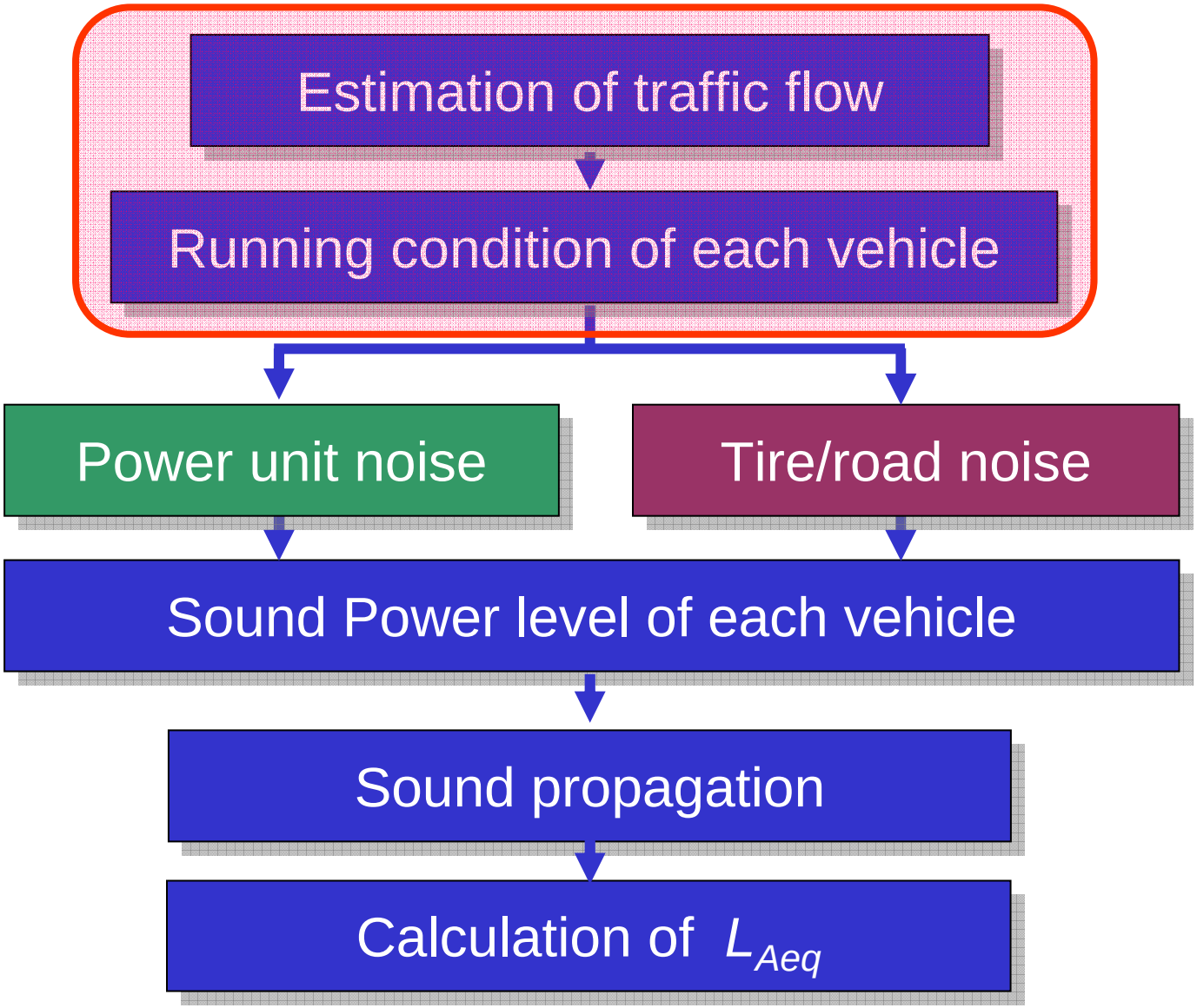
Study of the effect of AVAS on road traffic noise

JASIC

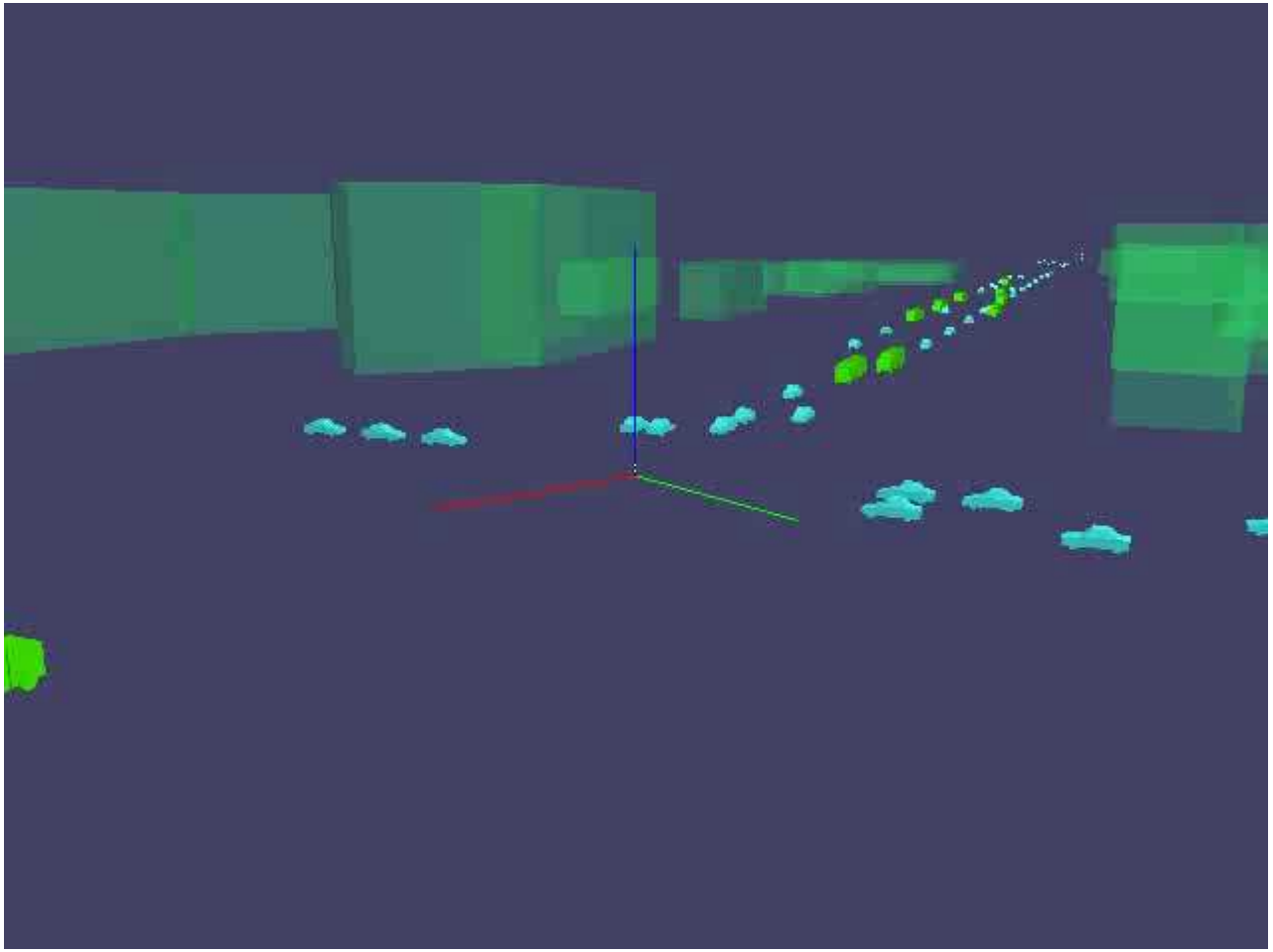
Contents

- Calculation flow of road traffic noise
- Effect of the increase of EV
- Influence of the installation of AVAS

Calculation flow of JARI model [1], [2], [3]

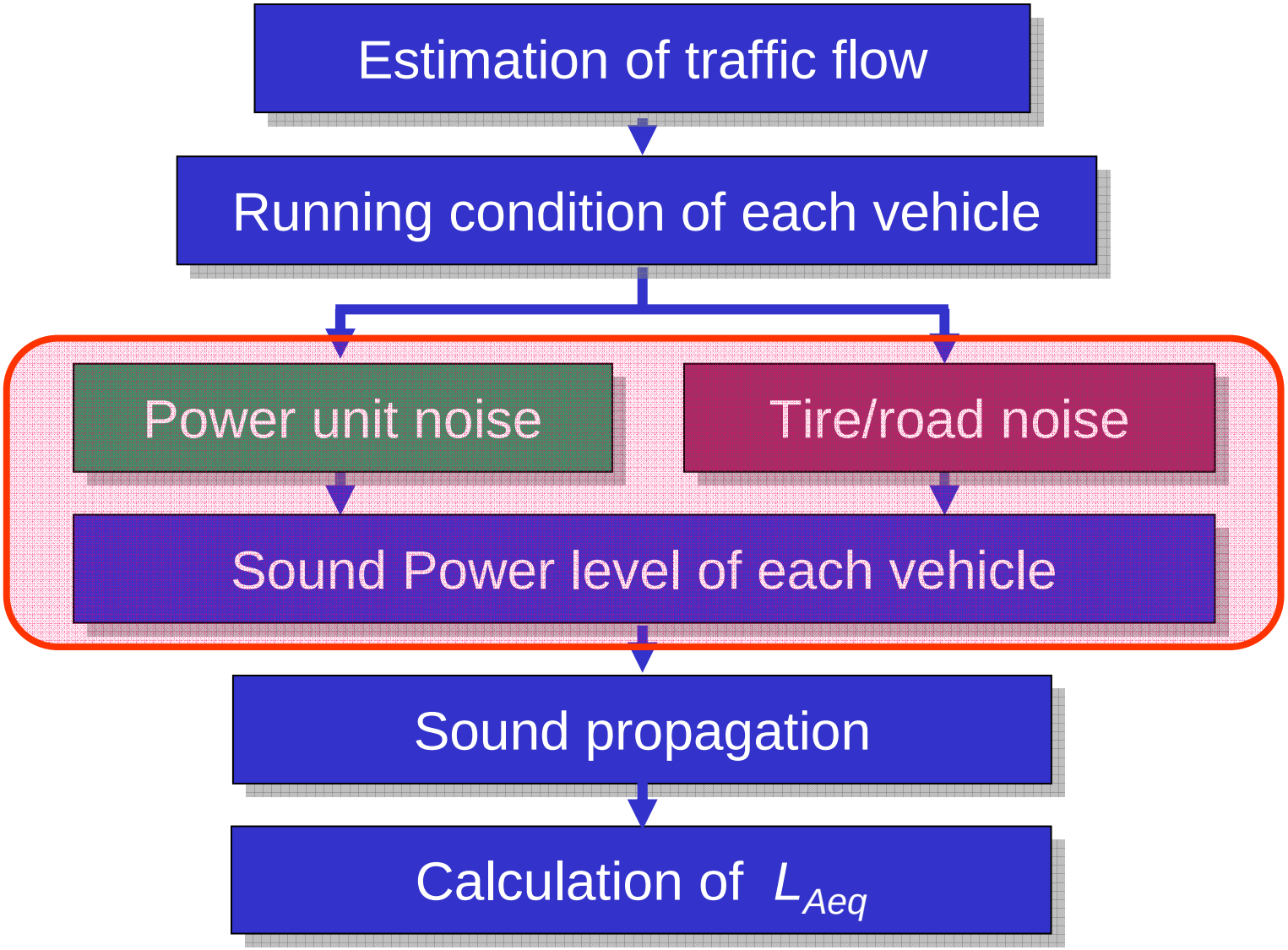


Traffic flow simulation

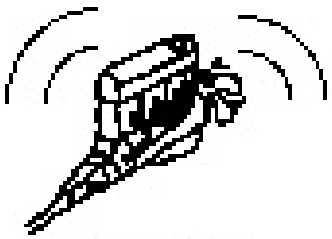


Running condition (speed, acceleration, engine speed, position) of each vehicle is estimated.

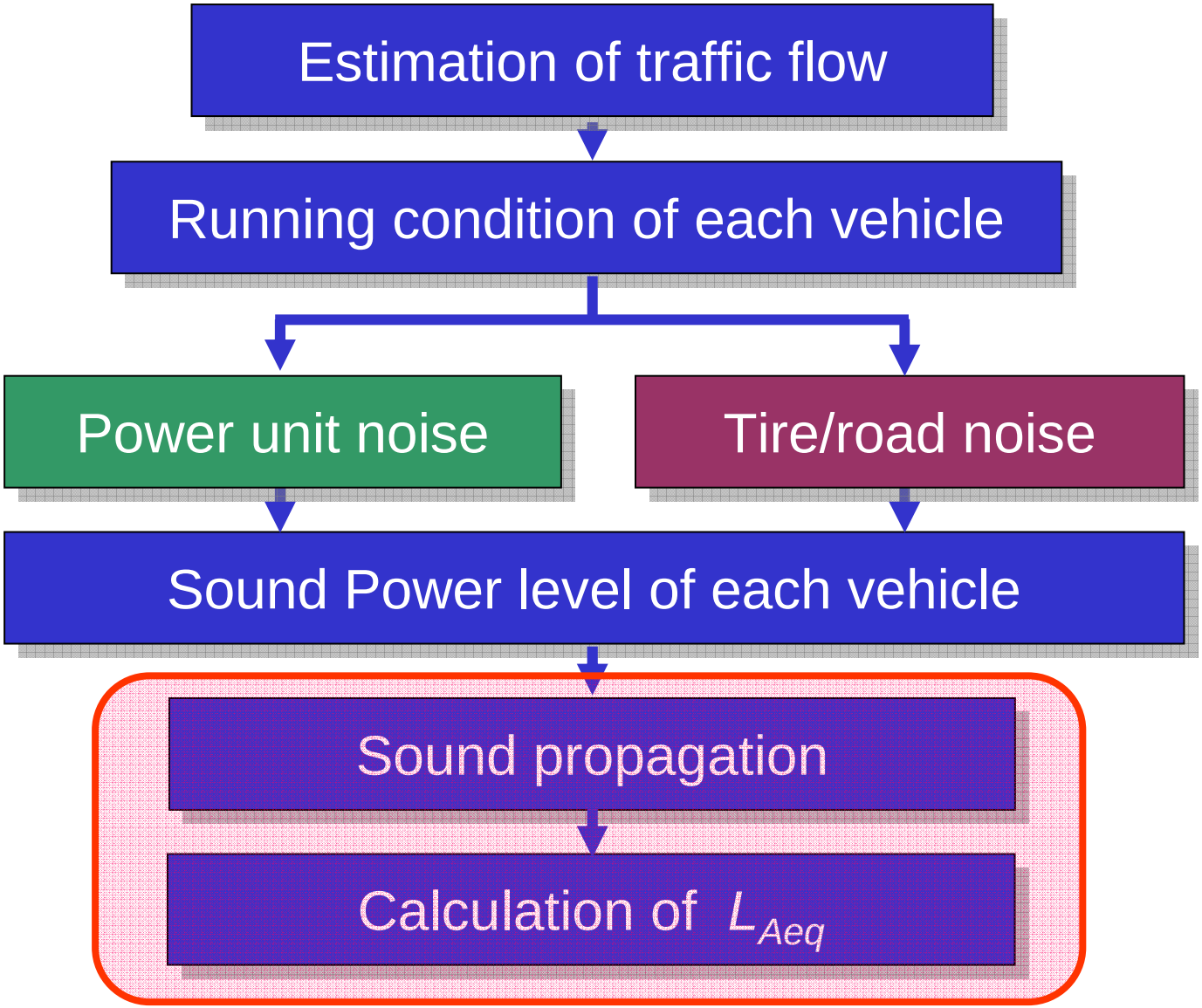
Calculation flow of JARI model [1], [2], [3]



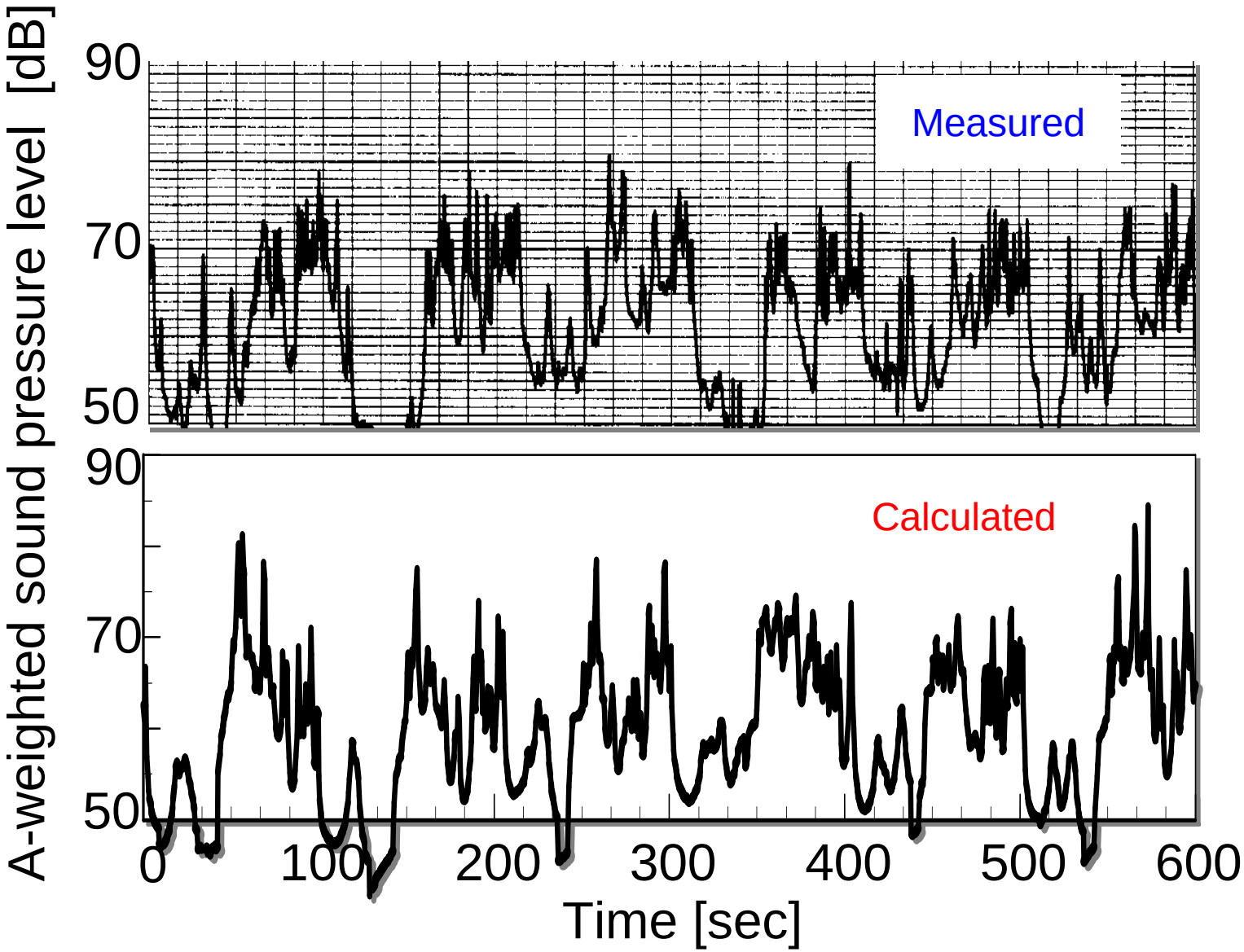
Sound power level model of ICE vehicle

Noise sources	Models
Power unit noise 	$L_{WE} = A_0 + A_1 \log \frac{S}{S_0} + A_2 L$ S : Engine speed [rpm], L : Engine load [%]
Tire/road noise 	$L_{WT} = C_0 + C_1 \log \frac{V}{V_0}$ V : Vehicle speed [km/h]

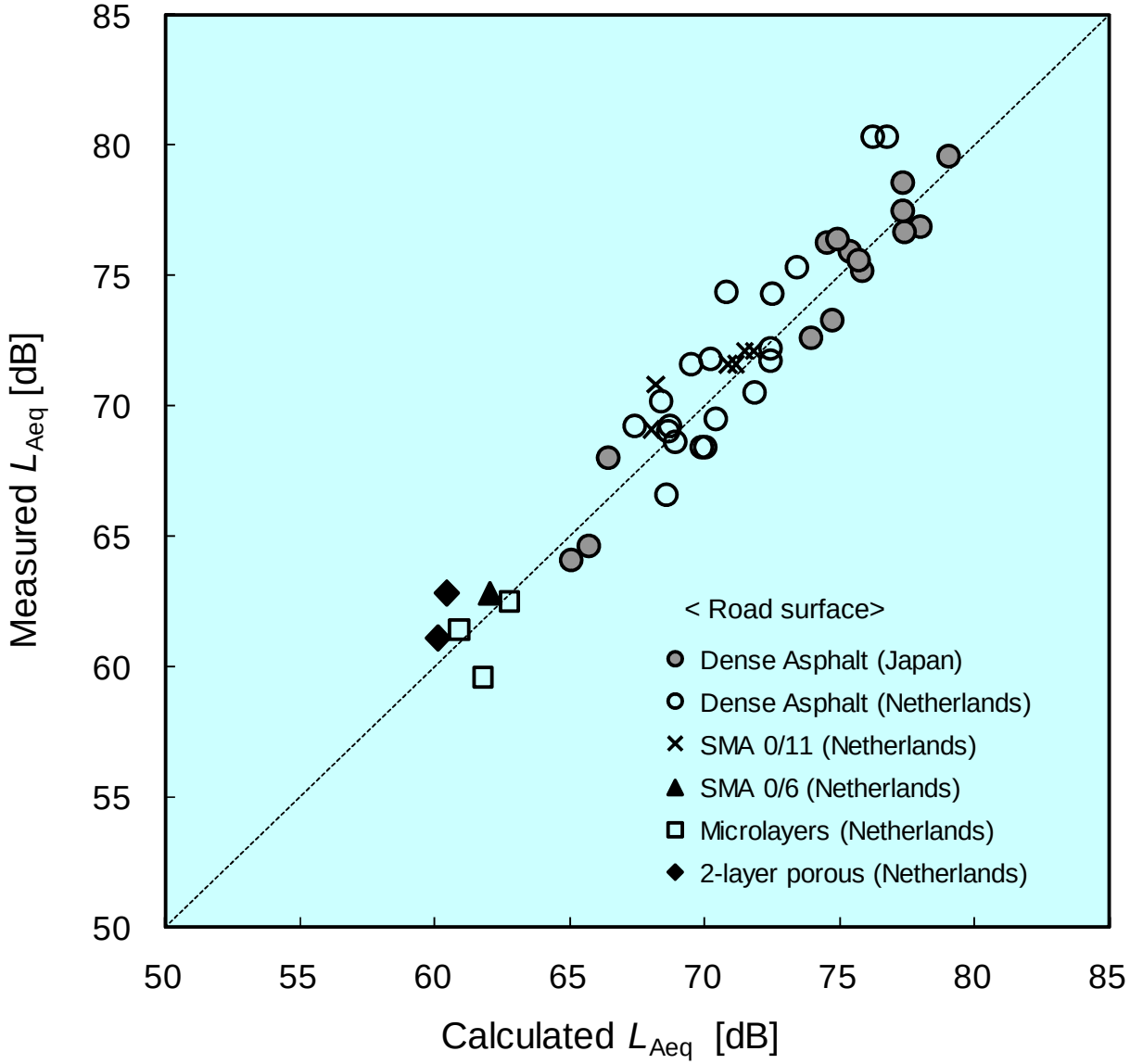
Calculation flow of JARI model [1], [2], [3]



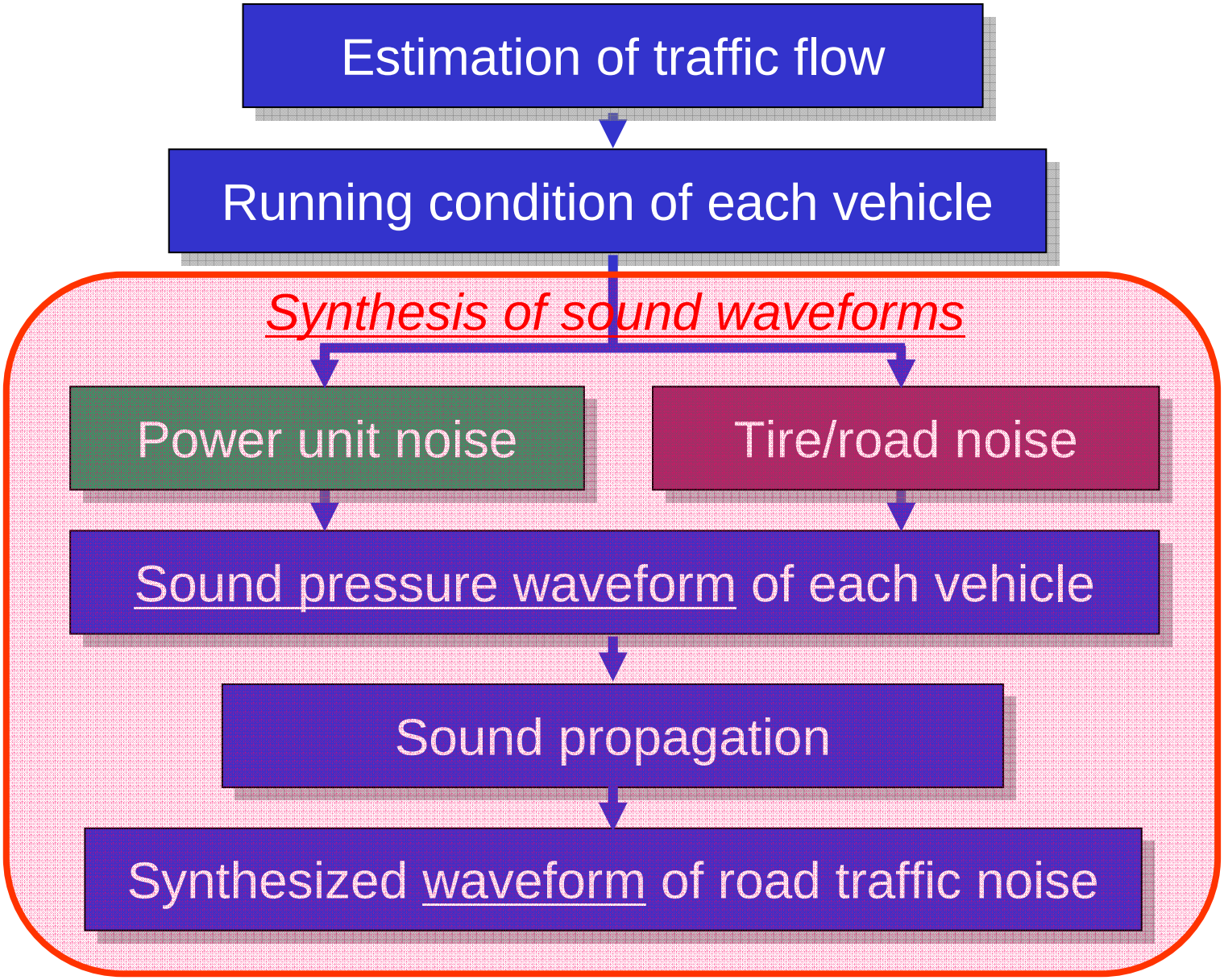
Time history of road traffic noise



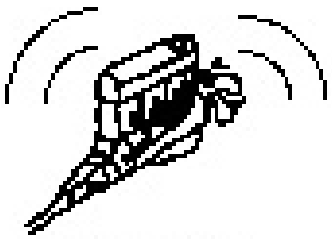
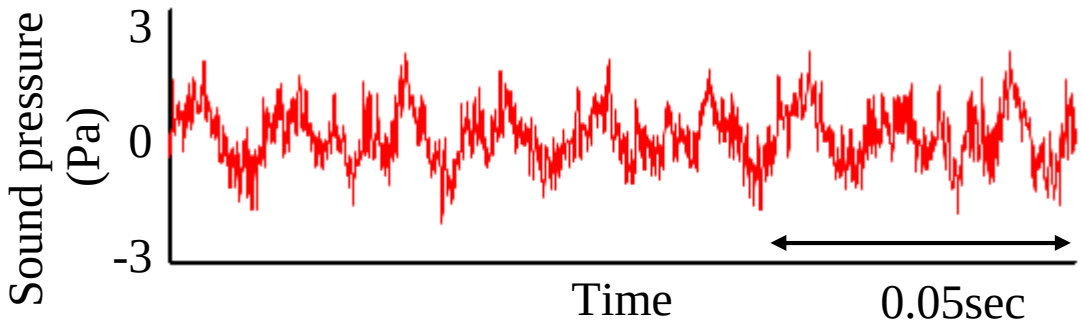
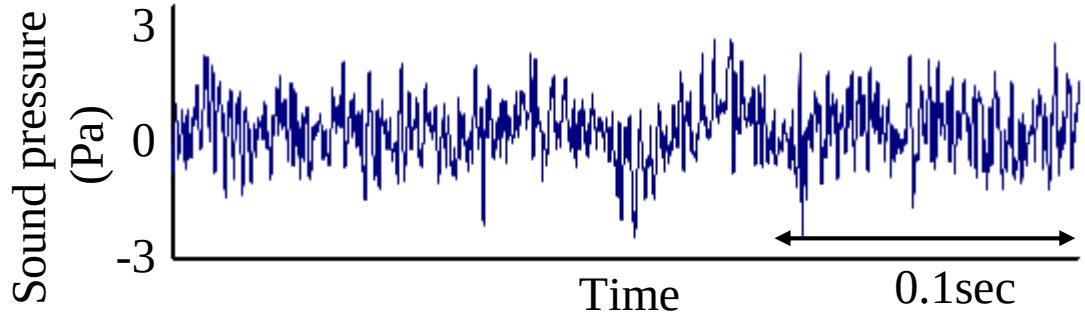
Comparison of measured and calculated L_{Aeq}



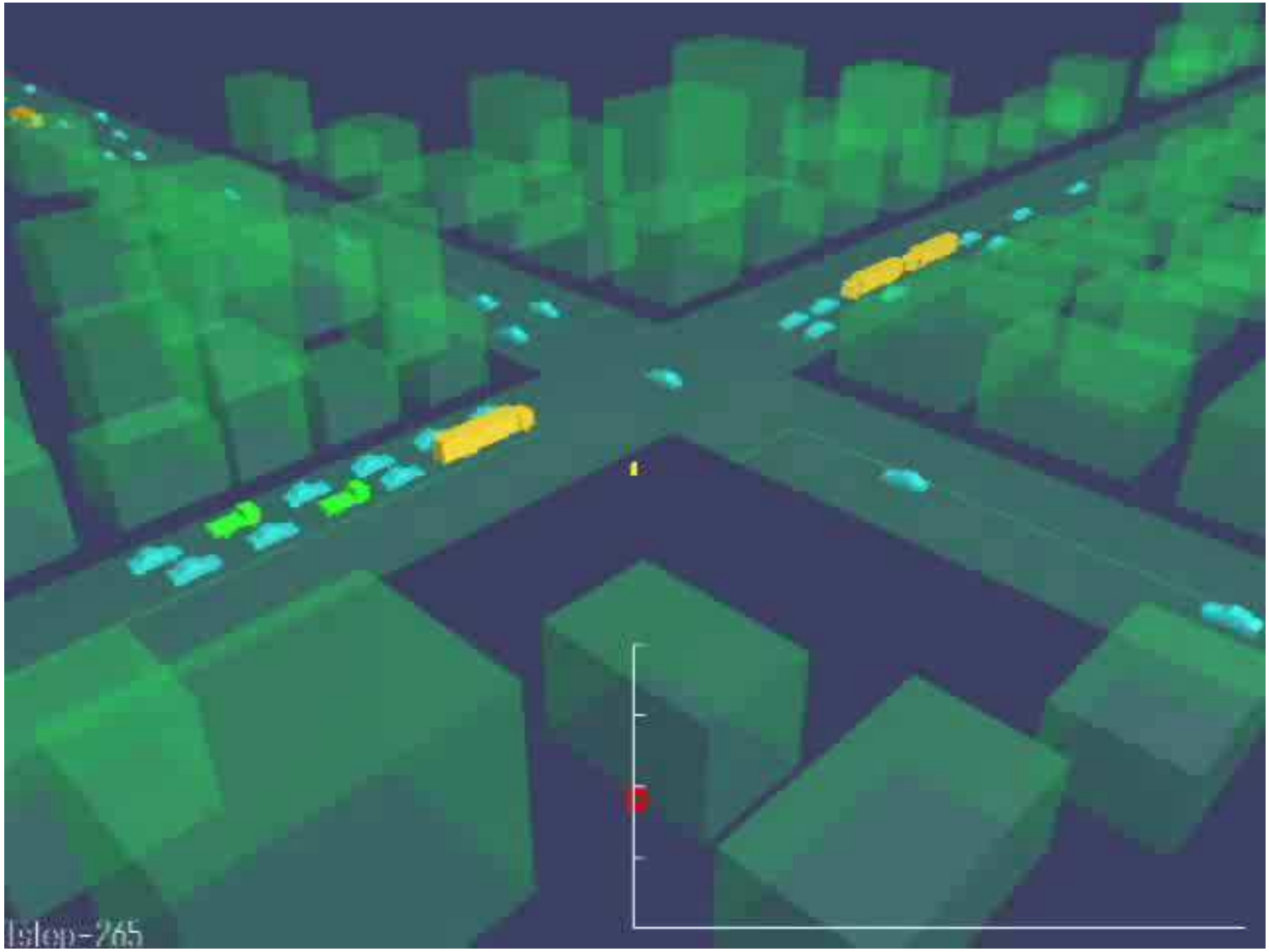
Aural simulation of road traffic noise [4]



Waveforms from noise sources of ICE vehicle

Noise sources	Sound pressure waveforms
Power unit noise 	
Tire/road noise 	

Visual and aural simulation [4]



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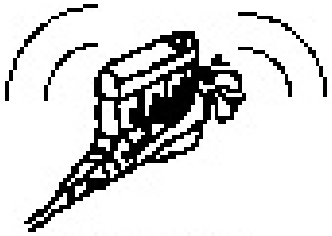
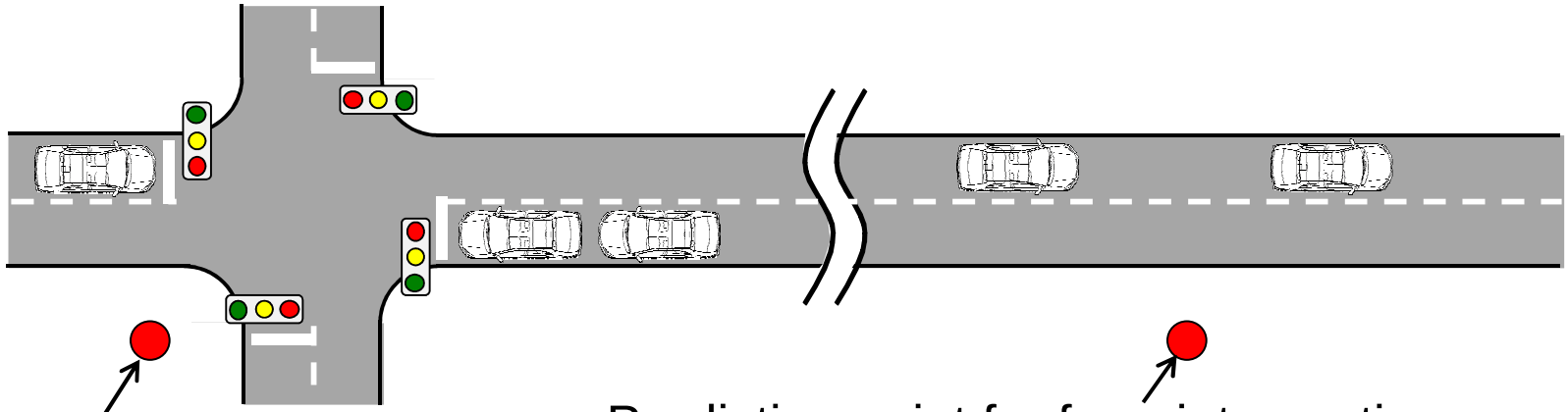
Noise radiation of EV

Noise sources	Noise radiations
Power unit noise 	Not radiated
Tire/road noise 	Radiated same as ICE vehicle

Prediction area(1): Urban area



•Prediction point far from intersection

•Prediction point near intersection with traffic light

Traffic conditions

•Traffic volume: 1,434 vehicles/hour

•Ratio of vehicle categories:

Passenger car	85.9 %
Light truck	5.1 %
Medium truck	5.7 %
Heavy truck	0.6 %
Motorcycle	2.7 %

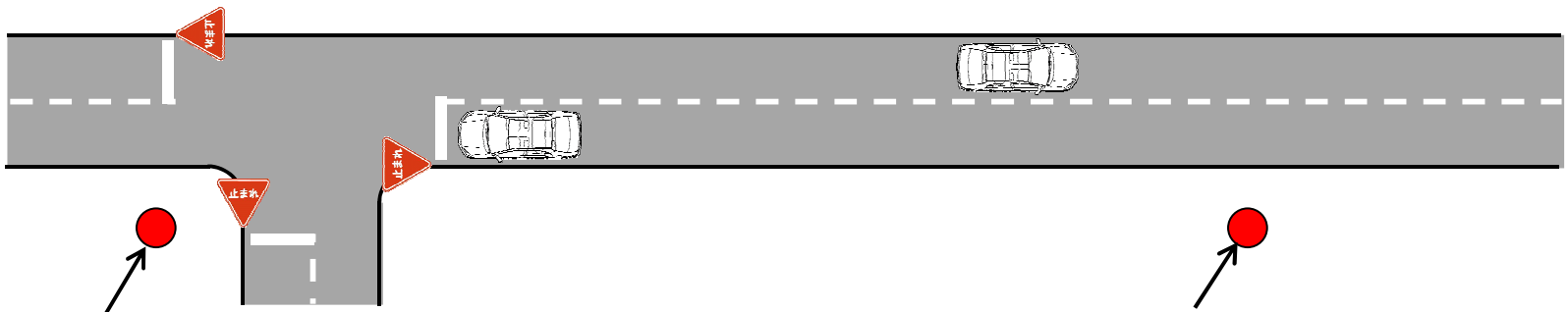
•Speed limit: 50 km/h

Prediction results in urban area: Effect of the increase of EV [5]

Ratio of EV (in passenger car) [%]	Near intersection		Far from intersection	
	L_{Aeq} [dB]	Decrease [dB]	L_{Aeq} [dB]	Decrease [dB]
0	70.3		70.4	
20	70.1	0.2	70.4	0.0
40	70.0	**0.3**	70.2	**0.2**

When EVs increase to 40 %, it is predicted that road traffic noise L_{Aeq} in urban area decreases 0.2 dB to 0.3 dB.

Prediction area(2): Residential area



•Prediction point far from intersection

•Prediction point near intersection

Traffic conditions

•Traffic volume: 60 vehicles/hour

•Ratio of vehicle categories:

Passenger car	100 %
Light truck	0 %
Medium truck	0 %
Heavy truck	0 %
Motorcycle	0 %

•Speed limit: 30 km/h

Prediction results in residential area: Effect of the increase of EV [5]

Ratio of EV (in passenger car) [%]	Near intersection		Far from intersection	
	L_{Aeq} [dB]	Decrease [dB]	L_{Aeq} [dB]	Decrease [dB]
0	55.2		54.2	
20	54.2	1.0	53.6	0.6
40	53.3	**1.9**	52.9	**1.3**

When EVs increase to 40 %, it is predicted that road traffic noise L_{Aeq} in residential area decreases 1.3 dB to 1.9 dB.

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Sound radiation from EV with AVAS

Sound sources	Sound radiations
Power unit → AVAS  	Type: Continuous sound Level: 50 dB(A) at 2 m forward of vehicle, 1.2 m in height (Constant level, equals to idling of ICE vehicle) Speed range in which sound is generated: $0 < \text{Speed} \leq 20$ km/h
Tire/road noise 	Same as ICE vehicle

Prediction results: Influence of the installation of AVAS [5]

Ratio of EV (in passenger car) [%]	Residential area					
	Near intersection			Far from intersection		
	L_{Aeq} [dB]	Decrease [dB]		L_{Aeq} [dB]	Decrease [dB]	
		Without AVAS	**With AVAS**		Without AVAS	**With AVAS**
0	55.2			54.2		
20	54.2	1.0	**1.0**	53.6	0.6	**0.6**
40	53.3	1.9	**1.9**	52.9	1.3	**1.3**

Even if AVAS is installed in EV, it doesn't influence road traffic noise.

Conclusion

- When EVs increase to 40 %, it is predicted that road traffic noise L_{Aeq} in urban area decreases 0.2 dB to 0.3 dB, and L_{Aeq} in residential area decreases 1.3 dB to 1.9 dB.

- The effect of AVAS installed in EV was examined, where the sound was generated at the same level as idling of ICE vehicle in the speed range in 20 km/h or less.
  As a result, it has been found that the sound from AVAS doesn't influence road traffic noise.

Reference

[1] Y.Oshino and H.Tachibana, "Prediction of road traffic noise taking account of transient vehicle running condition", *Proceeding of Inter-noise 93* (1993)

[2] Y.Oshino, K.Tsukui and H.Tachibana, "Road traffic noise prediction taking account of transient vehicle running condition", *Proceeding of Inter-noise 96* (1996)

[3] T.Suzuki, K.Tsukui, Y.Oshino and H.Tachibana, "Road traffic noise prediction model around signalized intersections", *Proceeding of Inter-noise 2003* (2003)

[4] M.Tanaka, T.Suzuki, Y.Oshino and H.Tachibana, "Aural simulation of road traffic noise", *Proceeding of Inter-noise 2008* (2008)

[5] National Traffic Safety and Environment Laboratory, “車両接近通報装置の特性評価と基準化に関する調査 (in Japanese)", 2007

Thank you